PROVISIONAL INTELLIGENCE REPORT

THE MOLYBDENUM SUPPLY SITUATION IN THE SOVIET BLOC

CIA/RR PR-30
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CIA/RR PR-30

(ORR Project 25-52)

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SECURITY INFORMATION

THE MOLYBDENUM SUPPLY SITUATION IN THE SOVIET BLOC*

Summary

In the Soviet Bloc, as in the US, molybdenum is used chiefly as an alloying element in the manufacture of iron and steel. Because the Soviet Bloc is better supplied with various other ferroalloy metals, molybdenum is conserved for high-priority uses [redacted] 25X1

25X1

[redacted]

The principal producer of molybdenum in the Soviet Bloc is the USSR, which produced an estimated 3,550 metric tons** in 1952. The total production of other Soviet Bloc producers (Communist China, North Korea, and Rumania) amounted to less than 400 metric tons. The USSR also is the principal Soviet Bloc consumer of molybdenum. Relatively small amounts are consumed also by the iron and steel industries of Czechoslovakia, Poland, East Germany, and Hungary.

Before 1940 the USSR was dependent almost entirely on imports of molybdenum. During the Second Five Year Plan (1933-37), when extensive searches for molybdenum were initiated, the USSR made its first real start at producing molybdenum. Many deposits had been discovered and were in process of being exploited when the Germans occupied parts of the USSR. With the loss of the deposits in the economic region*** of the Transcaucasus (V), the Russians concentrated on developing mines in Kazakhstan (Xa) and East Siberia (XI). The production from these deposits, together with Lend-Lease shipments, greatly eased the deficiency of the USSR in this metal. With the end of Lend-Lease in 1945, molybdenum became one of the scarcest metals in the USSR.

* This report contains information available as of 15 December 1952.
** All estimates in this report are in terms of molybdenum metal unless otherwise specified.

[redacted] 25X1

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Efforts were concentrated on restoring mines in reoccupied areas and on increasing the output of molybdenum from the complex ores. The main producing areas in the USSR at the present time are the Transcaucasus, Kazakhstan, and East Siberia, and there are indications that the Far East (XII) has potential value.

Total reserves of molybdenum in the USSR cannot be estimated. It is probable, however, that reserves are much larger than the 20,000 metric tons reported for 1940. New deposits discovered and exploited during and after World War II and the development of a process for recovery of the metal from complex ores have greatly improved the molybdenum supply situation.

Since 1945, when Lend-Lease shipments were discontinued, the USSR has received very little molybdenum from the West. Between 1945 and 1949 the US, which was the only important Western source of molybdenum, did not ship it in appreciable amounts. In 1950 an embargo control on molybdenum shipments to the Soviet Bloc was established by the countries in COCOM (Coordinating Committee on East-West Trade), and this resulted in even smaller imports of molybdenum by the Soviet Bloc. Until recently the USSR has endeavored to obtain molybdenum from the West in any amounts and regardless of the price. A possible indication of an improved molybdenum supply situation in the USSR, however, is seen in the fact that the Russians refused an offer [redacted] 25X1
1952 because the price was too high.

Although it is impossible to measure the quantities of illicit molybdenum imports into the Soviet Bloc, it is known that since the imposition of COCOM controls, significant amounts of molybdenum have continued to be transshipped through Western Europe to the Satellites at premium prices and that trade representatives of Czechoslovakia, Poland, Hungary, and East Germany continue to expend considerable effort in attempts to procure molybdenum in the West. There have been numerous other indications of molybdenum shortages in the Satellites. These facts serve as an indication that imports of molybdenum from the USSR to the Satellite countries have fallen short of meeting their demands.

In conclusion, the Soviet Bloc supply situation for molybdenum has improved considerably in the postwar years. This is especially true for the USSR, whose indigenous production, together with imports from Communist China, appears to provide sufficient molybdenum

for current essential industrial requirements, rather narrowly defined, and to leave a small surplus for stockpiling and for exports to the European Satellites. The situation in the European Satellites, however, is not so favorable, and available supplies, obtained almost exclusively from the USSR, are not sufficient to meet all essential needs. Reserves in Communist China are substantial, and, though production has not yet reached a high level, it appears that the Soviet Bloc is in a position to obtain increased supplies through further exploitation of resources in both the USSR and Communist China.

I. Introduction.

Molybdenum has been produced on a commercial scale only since 1900, chiefly for its uses in ferrous metallurgy. During World War II, molybdenum utilization increased significantly as a result of the large wartime demand for special-purpose steels.

Molybdenum is a metallic element which occurs in nature only in chemical combination. The chief commercial molybdenum-bearing ores contain molybdenite (MoS_2), 60 percent of which is molybdenum. Molybdenite is mined both separately, as a noncomplex ore, and to an increasing extent as a complex ore, in conjunction with tungsten and copper, especially the latter. Molybdenum deposits vary greatly in the amount of molybdenite that they contain. Smaller deposits average as high as 3 percent molybdenite, whereas the larger deposits usually average 0.4 to 0.7 percent. The amounts of molybdenite found in conjunction with tungsten and copper ores are still smaller, averaging from 0.03 to 0.08 percent molybdenite. After extraction is completed, molybdenum normally enters into commerce as a concentrate.* Standard concentrates in general use contain from 65 to 85 percent molybdenite.

* Quantities and prices are commonly given in terms of a concentrate. For the sake of simplicity, this practice has not been used in this report.

In the USSR as in the US, approximately 85 to 90 percent of the molybdenum produced is consumed by the iron and steel industry. The remaining 10 to 15 percent is consumed by the chemical, ceramic, and electronics industries.

Molybdenum is added to steel in the form of calcium molybdate, ferromolybdenum, or molybdic oxide. It serves best in steels which also contain nickel, chrome, or manganese. Only small quantities of molybdenum are required, usually less than 0.20 percent. Molybdenum is specified in many of the engineering alloy steels because of the following beneficial effects:

1. Molybdenum is a nonoxidizable metallic element imparting a large measure of hardenability to steel. This is useful where close hardenability control is desired.

2. Molybdenum is unique in its powerful effect in increasing the high-temperature tensile and creep strengths of alloy steels.

3. Additions of molybdenum to high-chromium and chromium-nickel steels greatly enhance the resistance of these steels to many forms of corrosive attack.

4. Molybdenum steels are less susceptible to temper-brittleness than alloy steels in which molybdenum is not present.

Molybdenum steels are used in aircraft and automobiles for such parts as shafts, valves, pumps, gears, hollow-steel propeller blades, and seamless tubing. Molybdenum steel is essential in certain types of armor-piercing shells and armor plate. At the present time, high-temperature alloy steels containing molybdenum are finding wide application in jet engines, guided missiles, and turbo-superchargers.

Small amounts of pure molybdenum are used for such purposes as heating elements in high-temperature resistance furnaces, focusing cups and other parts of X-ray tubes, filament supports in lamps and radio tubes, and electric-contact points.

II. USSR.

A. Geographic Distribution of Deposits.

[redacted] the economic regions in the USSR considered to have potential economic value as sources of molybdenum are the Transcaucasus (V), Kazakhstan (Xa), East Siberia (XI), and the Far East (XII).* 25X1

Before 1917 the only known deposits of molybdenum were in the Gutay district of Chita Oblast (East Siberia). Facilities were present for the concentration of the mined ore, but production was insignificant. Beginning in 1917, several molybdenum-tungsten deposits were discovered in the Georgian SSR and on the Pacific Coast, and these deposits became the chief sources of molybdenum in the USSR through the period of the First Five Year Plan (1928-32). These deposits, however, did not produce enough to supply growing domestic requirements, and in 1934 prospecting for molybdenum was started in the Transcaucasus.

The opening of important new deposits of molybdenum as a result of the prospecting begun in 1934 has caused a substantial change in assessments of the economic potentials of various regions. These changes in assessment are given in Table 1,** where a decided percentage shift is revealed between the deposits as known in 1933 and the deposits as known in 1938. Whereas in 1933 the significant locations were the Georgian SSR and the Pacific Coast, in 1938 the Karbardian ASSR (Transcaucasus) and Altay Kray (Kazakhstan) contained far greater percentages of known reserves than the other locations. 1/***

One of the greatest achievements of the geological prospecting work under the Second Five Year Plan (1933-37) was the discovery and investigation of the Tyrny-Auz molybdenum-tungsten deposit in the Karbardian ASSR. Since then, as a result of 25X1

[redacted]

Table 1

Distribution of Molybdenum Reserves in the USSR
1933, 1938

Location	Percent 1933	1938
Georgian SSR	61.6	1.6
Pacific Coast	27.8	12.3
Chita Oblast	10.6	6.7
Altay Kray	N.A.	6.0
Karbardian ASSR	N.A.	64.4
Others	N.A.	9.0

intensive geological investigation, additional reserves in the deposit have been discovered each year, and Tyrny-Auz now constitutes one of the most important molybdenum-tungsten deposits in the USSR. 2/ As a source of molybdenum, this deposit is still the largest in the USSR. The deposits of the Karbardian ASSR, however, are not confined to the Tyrny-Auz deposit. The Agarak, Pirdoudan, and Karobi copper deposits contain molybdenum and show promise of becoming some of the main sources for the extraction of this metal in the USSR.

Kazahkstan is second only to the Karbardian ASSR as a potential source of molybdenum. Very large copper deposits at Kounrad and Bosche-Kul contain molybdenum. The exploitation of these deposits also makes possible the extraction of molybdenum. Large deposits of molybdenite are located at East Kounrad. Promising prospects for molybdenum such as the Chindagatuy deposit are also in evidence in the southeastern part of Altay Kray and in parts of the Gorno-Altay Autonomous Oblast adjacent to it. 3/

It is quite possible that two other important economic regions for molybdenum at the present time are East Siberia (XI) and the Far East (XII). It is known that the Russians have been sending out geological expeditions in the search for ferroalloying metals and that new deposits have been found. The production potential, however, remains unknown. Information on known deposits in East Siberia indicates that this region is a substantial producer of molybdenum, but very little information on the actual size of the deposits in the

Far East is available. The principal deposits there are Pervomayka, Davinda, Gutay, and Chindagatuy.

B. Description of Deposits.

1. Transcaucasus (Economic Region V).

a. Tyrny-Auz.

The molybdenum-tungsten deposit in Tyrny-Auz is a basic industrial asset in the Tyrny-Auz ore-bearing area, where deposits of tin, antimony, and other metals also are found. This deposit is the largest producer of molybdenum ore in the Soviet Bloc. 4/ The mine was developed in 1939-40 and began production in 1940. 5/ With the occupation of this area by the Germans in 1942, the production facilities were destroyed and were not restored until 1947, when capacity was estimated at 1,000 metric tons of ore per day. 6/ Production in 1947, based on restored capacity, has been estimated at 700 metric tons of molybdenum. 7/ Before the German occupation, one of the largest molybdenum-processing plants in the USSR was located at Tyrny-Auz. This plant was restored in 1947.

b. Pirdoudan.

It is reported that a copper-molybdenum ore deposit discovered in Pirdoudan before World War II is a promising source of molybdenum. 8/ Work was started on this deposit during the Fourth Five Year Plan (1946-50) in connection with the creation of a large molybdenum industry in the Armenian SSR. The plans called for the development of the molybdenum deposits in the Zangezurskiy Mountains. 9/ Production has been roughly estimated at 50 metric tons of molybdenum during 1947. 10/

c. Agarak.

The deposit in Agarak is located in the Mergenskiy Mountains of the Armenian SSR and is included in plans for the development of molybdenum resources. The ore is of low grade, containing about 0.03 to 0.04 percent molybdenum. Reserves in 1941 were estimated at 25,000 metric tons of molybdenum. 11/ Production has been roughly estimated at 50 metric tons of molybdenum during 1947. 12/

d. Karobi.

The deposit in Karobi contains low-grade ore which is associated with vein quartz but is uniform in molybdenum content. The mine has been equipped for a total output of 500 metric tons of ore per day, and a concentrating plant was scheduled to be built during the postwar period. 13/ No production or reserve figures are available, but, on the basis of equipment and analysis of ore, production in 1947 has been roughly estimated to have been 70 metric tons of molybdenum. 14/

2. Kazakhstan (Economic Region Xa).

a. Kounrad.

A large copper-molybdenum deposit, which runs about 0.5 percent molybdenite and contains an estimated 16,700 metric tons of molybdenum, is located in Kounrad. 15/ The mine was reported to have eight vertical shafts with an electrically operated elevator to haul ore to the surface. 16/ Production during 1946 and 1947 has been estimated at 300 to 480 metric tons of ore per day. 17/ In converting this to annual production of molybdenum, the figure of 300 metric tons of ore per day was arbitrarily used for 1946 and 480 metric tons for 1947. This would give an estimated annual production of 270 metric tons of molybdenum in 1946 and 425 metric tons in 1947. 18/

b. East Kounrad.

The molybdenum deposit in East Kounrad is nearly as large as the one at Tyrny-Auz. It was developed during World War II in order to offset some of the loss which resulted from German occupation of the deposits in the Transcaucasus. World War II production is not known, but it has been reported to have yielded more molybdenum in 1942 than all other such enterprises. 19/ This is probably an exaggeration, but it is an indication of the potential of this deposit.

The ore has been reported to contain 0.8 percent molybdenite. 20/ Estimated annual production at East Kounrad, based on reported daily ore production, is 340 metric tons of molybdenum in 1946 and 550 metric tons in 1947. 21/

c. Chindagatuy.

Work was started on the deposit in Chindagatuy during the Third Five Year Plan (1938-42). Production, however, was insignificant up until 1943, at which time the mine was expanded to offset partially the loss of mines in the Transcaucasus. The ore is of a low grade, and the molybdenite is associated with silica rock. The area in which this deposit is located is believed to have considerable potential value as a source of molybdenum. 22/ Production during 1946 and 1947 was estimated to have been 150 metric tons of molybdenum per year. 23/

d. Bosche-Kul.

The low-grade copper deposit in Bosche-Kul may eventually be worked and its molybdenum content recovered. Reserves of molybdenum have been reported at 7,200 metric tons. 24/

3. East Siberia (Economic Region XI).

a. Shakhtama.

The important deposit in Shakhtama in the Zabaykal'ye area was developed during World War II. Prisoners of war employed here in the years 1945-47 have estimated the average daily production during this period at 200 metric tons of ore. 25/ Production in 1946 and 1947 has been roughly estimated at 100 metric tons of molybdenum, 26/ but it is possible that production is much higher at the present time. The increase would be dependent on the degree to which the Russians have mechanized this mine since 1947. During the period 1945-47, reports have stated that a horse-drawn car was used for transporting ore from the mine to the mill and that manpower was used in moving ore cars in the inclined shafts and levels. 27/

b. Gutay.

The deposit in Gutay was the sole producer of molybdenum in the USSR up to 1930. 28/ The ore has a molybdenite content of from 3 to 4 percent. 29/ In 1945, reserves were estimated to be small -- 135 to 190 metric tons of molybdenum. 30/ Production in 1946 and 1947 has been estimated at 50 metric tons of molybdenum per year. 31/ Thus it is probable that the reserves have been exhausted at this deposit.

c. Inkur.

An open-pit deposit reportedly containing a fair grade of ore is located in Inkur. Production in the period 1945-47, based on estimated daily outputs as reported during this period, 32/ has been estimated at 40 metric tons of molybdenum annually. The extent of reserves is believed to be small. 33/

d. Davinda.

The deposit in Davinda was developed during World War II. Reserves are reported to be extensive and the ore of a fair grade. Production during 1946 and 1947 has been estimated at 125 metric tons of molybdenum annually, based on reported daily output of 100 metric tons of ore during this period. 34/

e. Pervomayka.

This open-pit deposit located in Pervomayka on the side of a mountain has been reported to have produced about 200 metric tons of ore per day in the period 1945-47. 35/ The ore is shipped to Gorodok for processing. Based on daily output, production in 1946 and 1947 has been estimated at 100 and 150 metric tons of molybdenum, respectively.

f. Others.

It is believed that some molybdenum is mined also at the following deposits, but there are insufficient data to make any definite statements on them: Belukha, Gorodok, Balkhash, and Bol'shoy Kebin.

4. Far East (Economic Region XII).

a. Ust'-Umal'ta.

The deposit in Ust'-Umal'ta contains small veins ranging from 0.6 to 2.4 percent molybdenum. Production is estimated at 50 metric tons of molybdenum in 1946 and 100 metric tons in 1947. 36/

C. Production.

Before World War II, Soviet molybdenum production was insignificant, as indicated by the Third Five Year Plan (1938-42), which set forth the hope of increasing output by 12.3 times from 1937 to 1942. 37/ The development of the Tyrny-Auz molybdenum deposit in 1939-40 somewhat eased dependence upon small sources such as Ust'-Umal'ta and Gutay. Furthermore, extraction of molybdenum from the Kounrad copper mine was initiated on an increasing scale, and the deposit of molybdenum at East Kounrad was being developed. Thus, despite the destruction of Tyrny-Auz by the Germans in 1942, molybdenum production in 1943 was three times that in 1940. 38/ The increase of production from Kounrad and East Kounrad continued during the war and was augmented by the operations of small new mines such as Shakhtama, Davinda, Pervomayka, and Chindagatuy. The magnitude of total increase in Soviet molybdenum output during World War II may be judged by the target of the Fourth Five Year Plan (1946-50) for an increase of only 2.1 times in the period 1945-50 as compared with the increase of 12.3 times in the period 1937-42. 39/

At the end of World War II, approximately two-thirds of all Soviet molybdenum production came from Kazakhstan (Xa) and one-third from East Siberia (XI). This total apparently did not include Tyrny-Auz, the restoration of which does not seem to have occurred until 1947, when a large increase in molybdenum production was noted.

Estimated production figures for molybdenum in the USSR for the immediate postwar years are given in Table 2.* They have been estimated on the basis of a study of the producing regions.

The totals given in Table 2 do not represent the actual amounts of molybdenum available to industry. In the processing of the ore, a certain percentage of the molybdenum is lost depending on the type of ore. The average loss is about 15 percent. The revised figures for 1940 and 1942-52 are given in Table 3.**

Since the 1930's there has been practically no official publication of actual amounts of molybdenum produced. From 1940

* Table 2 follows on p. 12.
** Table 3 follows on p. 13.

Table 2

Estimated Production of Molybdenum in the USSR by Principal Deposits
1946-47

Metric Tons

Economic Region	Deposit	1946	1947
Transcaucasus (V)	Tyrny-Auz	50	700
	Pirdoudan	25	50
	Agarak	50	50
	Karobi	25	70
Kazakhstan (Xa)	Kounrad	270	425
	East Kounrad	340	550
	Chindagatuy	100	150
	Bosche-Kul	N.A.	N.A.
East Siberia (IX)	Shakhtama	100	100
	Gutay	50	50
	Inkur	40	40
	Davinda	125	125
	Pervomayka	100	150
Far East (XII)	Ust'-Umal'ta	50	100
Total		1,325	2,560

on, the Russians have published production figures in terms of percentage increase, using 1940 as the base year. The wide range in estimated production for the year 1940 -- 210 40/ to 1,220 41/ metric tons of molybdenum -- did not lend itself as a basis for estimating production during the following years. Therefore, a study on the output of individual deposits was made in order to arrive at the most reasonable estimate for the year 1940. This figure was used as a base in computing yearly production where the reported percentage increases seem reasonable. By interpolation, it was possible to estimate production for the years in which percentage increases were not published. Production of molybdenum in the USSR for these years is shown on the accompanying chart, Production of Molybdenum in the USSR, 1940-52.*

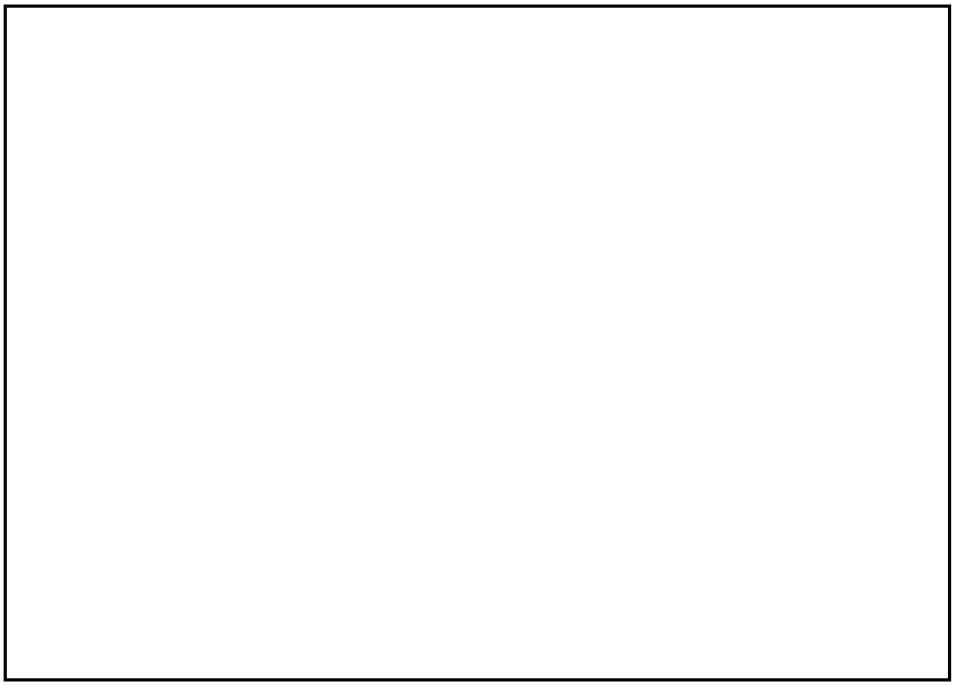
* Following p. 14.

Table 3

Estimated Production of Molybdenum in the USSR a/
1940, 1942-52

Metric Tons

Year	Amount
1940	350 b/
1942	650 b/
1943	1,155 c/
1944	1,500 b/
1945	1,450 d/
1946	1,125 e/
1947	2,175 e/
1948	2,550 f/
1949	2,800 f/
1950	3,045 g/
1951	3,300 h/
1952	3,550 h/



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The drop in production during 1945 and 1946 could be explained by the fact that much production was halted while scarce metallurgical equipment and specialists were transferred from areas which were developed during the war years to the Transcaucasus (V) in order to carry out the planned restoration of deposits located there. The sharp 1947 recovery in molybdenum production could mean almost complete restoration of production capacity at Tyrny-Auz and other deposits in this area.

D. Reserves.

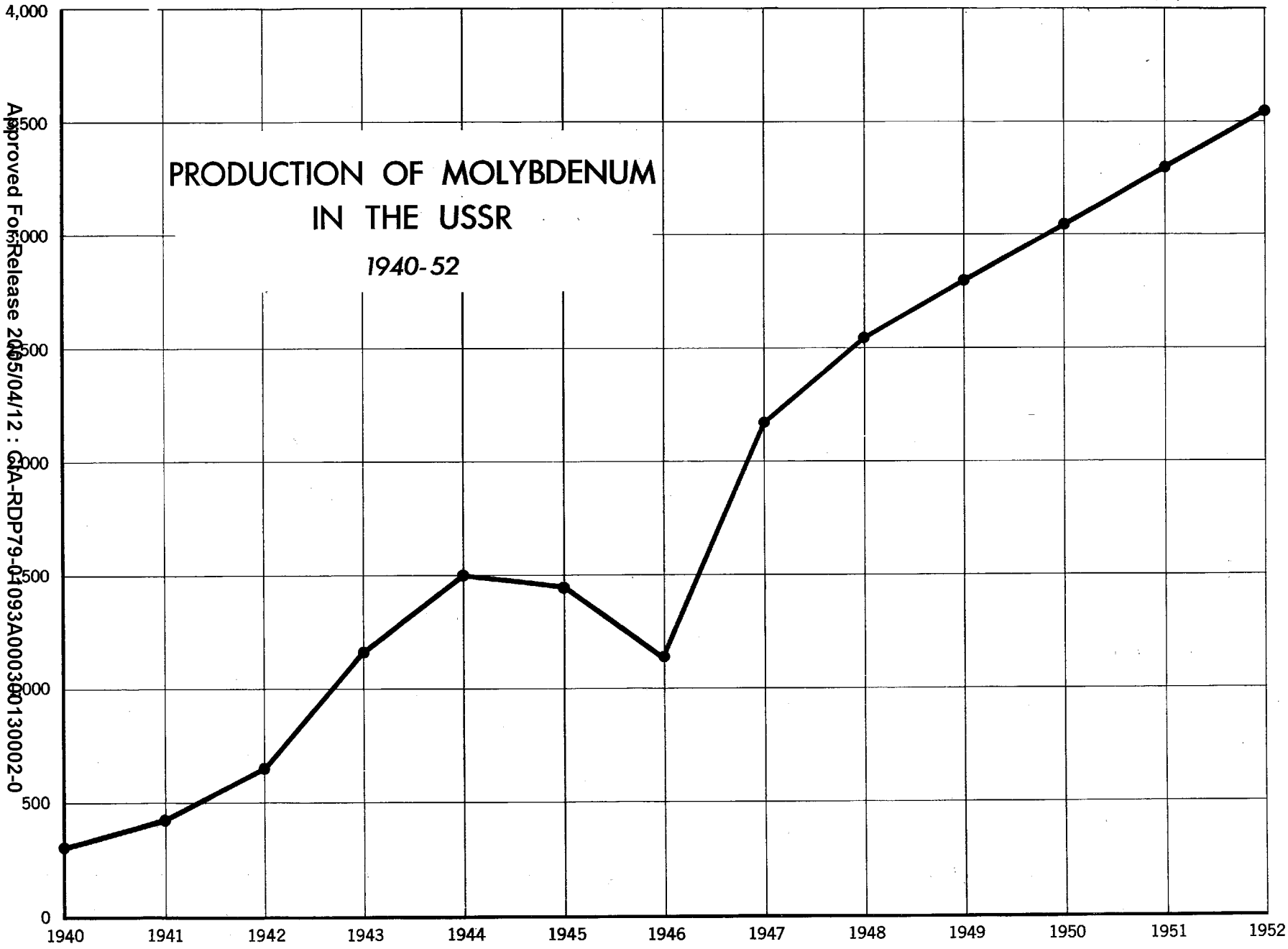
There are indications that molybdenum reserves in the USSR are much larger than the 1940 estimate of 20,000 metric tons. 50/ This results from concentrated efforts made by the USSR to discover new deposits and to develop a process for the recovery of molybdenum from complex ores such as copper and tungsten. These complex ores have great potentialities, but the extent to which the development of a process has progressed is not known. It is believed, however, that a full technical development has not yet been achieved, as some 42,000 metric tons of molybdenum are reported to be contained in idle copper mines. 51/ In general, it can be concluded that the processing of copper-molybdenum ore has good possibilities and that the working of more deposits may materially expand available supplies. The same conclusions can be made concerning the processing of tungsten-molybdenum ore.

At the present time, molybdenite is the most important source of molybdenum. Many of the reserves of molybdenite ores were developed during and after World War II, and information on reserves is not available.

In conclusion, it can be said that the reserves of molybdenum in the USSR have increased considerably since 1940. Large quantities are undoubtedly tied up in complex ores. Providing that this molybdenum content can be recovered, reserves should be sufficient to meet the essential requirements of the iron and steel industry for many years.

E. Trade.

The USSR has been a consistent and, whenever possible, a large importer of molybdenum. In 1939, imports of concentrates (65 percent molybdenite) exceeded 8,000 metric tons, and in earlier



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years considerable ferromolybdenum was imported. Up until 1945 the USSR was largely dependent on imports. During the war years, under Lend-Lease, the USSR imported large quantities of molybdenum from the US. With the end of Lend-Lease and an embargo on molybdenum shipments to the USSR from the COCOM countries, it became necessary for the USSR to develop its own resources and to import appreciable quantities from Norway, Chile, and North Korea. In 1950-51, when shipments from these countries stopped, the USSR became even more dependent on domestic resources. At the present time the Russians are exploiting the large reserves in Manchuria. During World War II the mine installations in Manchuria were damaged to some extent, and equipment was removed as a result of Soviet and Chinese Communist occupation. The mines are now believed to be partially restored, and all molybdenum produced is destined for the USSR. 52/

There can be no doubt that the USSR is endeavoring to obtain molybdenum from the West, but restrictions and prices have kept buying to a minimum. The US, which produces about 90 percent of the world's supply, has placed an embargo on all molybdenum products. During 1951 the Russians were still making inquiries about the availability of US molybdenum, and a Soviet official is reported to have asked whether or not molybdenum is available on the black or gray market. 53/ [redacted] 25X1

25X1 [redacted] were offered to the Russians, 54/ and the offer was refused because the price was too high. This is in rather sharp contrast to the period before 1950, when the USSR was buying all available molybdenum regardless of price. This might be an indication of an improved supply situation.

In conclusion, it can be said that the USSR at the present time is receiving very little molybdenum from the West and is meeting the essential demands of the iron and steel industry through indigenous and Manchurian production.

The known and estimated imports of molybdenum by the USSR in 1939-52 are given in Table 4.*

* Table 4 follows on p. 16.

Table 4

Known and Estimated Imports of Molybdenum by the USSR a/
1939-52

Metric Tons

Year	Amount
1939	4,100
1940	150
1941	1,070
1942	2,350
1943	1,830
1944	1,810
1945	740
1946	N.A.
1947	N.A.
1948	N.A.
1949	N.A.
1950	125 b/
1951	225 b/
1952	325 b/

a. Except for 1950-52, all imports are from the US only. 55/
b. Represents estimated production of Communist China, all of which goes to the USSR.

F. Uses and Substitutes.

1. Uses.

Despite large imports of molybdenum and plans for the production of an extensive variety of molybdenum steels, the USSR actually has produced only a modest assortment during the past decade. In 1939, only two molybdenum steels were in regular production. 56/ The first, a chrome-molybdenum-aluminum steel with 0.4 to 0.6 percent molybdenum, was used for various types of machine parts, seamless tubes, and high-pressure pipe fittings;

the second, a chrome-molybdenum-vanadium steel, high in chrome, with 0.5 to 0.8 percent molybdenum, was used primarily for complex dies and patterns but also was authorized as a substitute, after appropriate heat-treatment, for high-tungsten (17.5 to 19 percent tungsten) tool steel.

During World War II the use of molybdenum in steels increased. A new molybdenum steel containing 0.3 to 0.4 percent molybdenum was developed for the manufacture of machine parts, 57/ and in 1945 a high-speed tungsten-cobalt-molybdenum tool steel containing 0.3 to 0.6 percent molybdenum went into regular production. 58/ High-molybdenum tool steels and low-molybdenum structural steels were not yet in mass production in 1947, although Soviet plants were experimenting with them.

More important was the increased wartime use of molybdenum in different types of cast iron. Cast irons were produced containing 0.2 to 0.6 percent molybdenum for flywheels and diesel engine valves; 0.2 to 0.8 percent for automotive cylinder blocks, piston rings, and distributors; 0.4 to 1 percent for gear teeth and other miscellaneous purposes; and 0.8 to 1 percent for gear teeth. 59/

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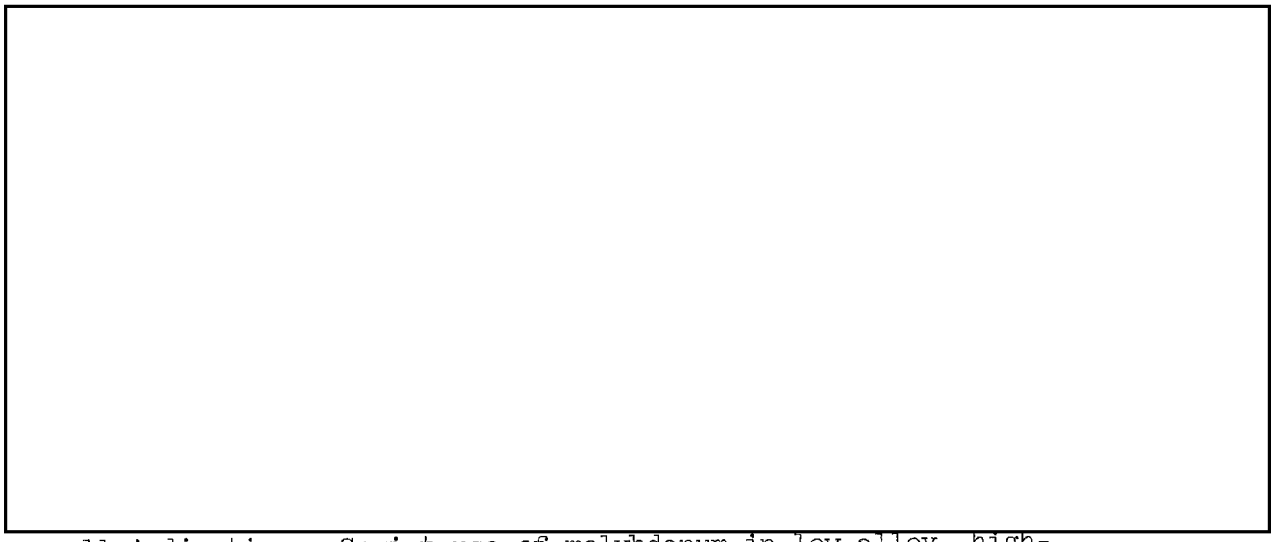

all indications, Soviet use of molybdenum in low-alloy, high-strength engineering steels is quite limited. For high-temperature applications, alloy steels made in the USSR follow in general the British and German analyses and make use of metals in plentiful

supply such as chrome, tungsten, and nickel. 61/ In the US a molybdenum addition of about 1 percent is considered essential to steels which are used at a temperature of 1,100° F, whereas the USSR follows the German practice of adding only about 0.35 percent molybdenum. 62/

The electronics industry is a substantial consumer of molybdenum. Requirements will undoubtedly increase with the expansion of this new and important industry. For most applications, such as vacuum tubes, pure molybdenum is required. Because of certain characteristics possessed by molybdenum, substitution by other metals such as tungsten is possible only to a limited extent.

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[redacted]

2. Substitutes.

The USSR has plentiful supplies of the metals -- tungsten, manganese, and boron -- which can satisfactorily serve as substitutes for molybdenum to a certain extent and in certain applications.

The use of boron can save a small portion of molybdenum. Examinations at Wright Field of captured equipment have indicated that boron steels are being made in the USSR. Soviet documents indicate that back in 1946 the USSR was aware of the use characteristics and limitations of boron. 64/

For high-temperature applications such as the manufacture of jet planes, British and German experience has shown that alloys containing high percentages of nickel and chrome and a little or no molybdenum give fairly satisfactory performances. Examinations of captured equipment indicate that the USSR is copying these nickel and chrome alloys to a large extent.

G. Consumption and Supply Position.

1. Consumption.

Direct data on consumption and requirements of molybdenum in the USSR are not available. Table 5, however, gives estimates of apparent consumption including stockpiling. These estimates were derived by adding production to imports and subtracting exports. It is reasonable to assume that in the period 1940-52 apparent consumption approximates actual consumption. This assumption is based on the fact that molybdenum has always been in short supply in the USSR and that increased production during the past few years has been only partially successful in overcoming loss of Western imports and increased requirements.

Table 5

Estimated Molybdenum Supply Position of the USSR
1940, 1942-52

Metric Tons

Year	Production	Imports	Exports a/	Apparent Consumption b/
1940	350	150	N.A.	500
1942	650	2,350	N.A.	3,000
1943	1,155	1,830	N.A.	2,985
1944	1,500	1,810	N.A.	3,310
1945	1,450	740	N.A.	2,190
1946	1,125	N.A.	N.A.	1,125
1947	2,175	N.A.	251	1,924
1948	2,550	N.A.	339	2,211
1949	2,800	N.A.	419	2,381
1950	3,045	125	500	2,670
1951	3,300	225	536	2,989
1952	3,550	325	582	3,293

a. Actual export figures are not available, but it is known that the USSR supplies the bulk of the molybdenum available to the Satellites. Therefore, it has been assumed that Soviet exports approximate Satellite consumption.
b. Includes stockpiling.

2. Supply Position.

A summary of the estimated molybdenum supply position of the USSR for 1940 and 1942-52 is also given in Table 5. No information is available on molybdenum stockpiles in the USSR. There is little doubt, however, that the USSR is stockpiling this metal, which is of great strategic value and the future needs of which must be met almost entirely by indigenous production. The stockpile inventory is probably quite small at the present time.

III. Satellites.

Specific data regarding the types and amounts of molybdenum-bearing alloy steels produced in the various Satellites are not available, but, generally speaking, special steels and armor plate produced in the Satellites follow Soviet specifications. Orders for these types of steels are placed by the Russians with the Satellite steel industries in sufficient volume to consume all or nearly all of the available supplies of critical alloying materials including molybdenum. There have been numerous reports to the effect that production of molybdenum-bearing steels has been seriously retarded in the Satellites because of the scarcity of that metal. 65/ Consequently, production of alloy steels containing molybdenum is restricted to the relatively narrow range of products of Soviet specification.

As pointed out earlier, the Soviet Bloc is richly endowed with alloying metals that can be utilized to a certain extent as substitutes for molybdenum. This substitution is being carried out whereever possible in the Satellites. Early in 1952, for example, the Vitkovice Steel Works in Czechoslovakia had reportedly been successful in substituting tungsten for molybdenum at a ratio of 2 to 1 in the manufacture of steels for use under high pressure and temperatures of 500° C. 66/ Whenever such substitution has not been possible, carbon steels have been utilized in applications where alloy steels normally would have been used. 67/

The iron and steel industry accounts for approximately 90 percent of the molybdenum consumption of the US. The remaining 10 percent goes to such uses as the ceramics, chemicals, and electronics industries and for applications in powder metallurgy. Approximately the same general consumption pattern applies for the Satellites, varying, of course, from country to country in accordance with the types and quantities of alloy steels produced and the status of other molybdenum-consuming industries.

The estimates of consumption by the iron and steel industry are based on the ratio of molybdenum consumption to raw steel production in the US for each of the years and are modified by a percentage factor judged to be suitable for each of the particular countries. Because of several factors, the Satellites do not consume molybdenum in the same ratio to raw steel production as does the US: (1) molybdenum is relatively plentiful in the US, and such possible substitute materials as tungsten and chromium are relatively scarce; (2) molybdenum is less plentiful in the Satellite area than are tungsten and chromium and most other possible substitute materials; and (3) alloy steel production as a percentage of total steel production is greater in the US than in the Satellites.

A. Communist China.

1. History of the Industry.

China proper has never been a significant producer of molybdenum. For example, in the year of highest production, 1940, about 15 metric tons of molybdenum concentrates were recovered from tungsten operations in South China. It is estimated that less than 6 metric tons of molybdenum were contained in these concentrates. 68/

The Japanese initiated large-scale molybdenum production in Manchuria in 1940, following the discovery of molybdenum in the lead and zinc ores of the Yang-chia-chang-tzu deposit. They built a flotation mill capable of handling 800 metric tons of ore per day in conjunction with the Yang-chia-chang-tzu mine. Production under the Japanese reached a peak level in 1944 and dropped sharply following the surrender in 1945. 69/ The occupying Soviet forces and local Chinese civilians looted the mine and ore-processing mill of machinery, ball bearings, electric motors, motor belting, and other capital equipment items. 70/ When the Chinese Communists attained control of the area, they undertook the rehabilitation of the mine and mill. The USSR supplied technicians and equipment to speed recovery and is now in full control of Manchurian molybdenum production. 71/

2. Principal Deposits.

The Yang-chia-chang-tzu deposit is by far the most important molybdenum deposit in Communist China. Estimated reserves are

8 million metric tons of ore with molybdenite content of 0.4 percent, equivalent to about 20,000 metric tons of metal. 72/ This estimate is based largely on studies of the deposit made by the Japanese before 1945, and it may well be that the reserves are even larger, as the area had not been fully explored.

The Ma-lu-kou mine in the Pen-ch'i district of Manchuria contains ore with 1.2 percent molybdenite together with copper and silver. The reserves are unknown, but they are believed to be relatively small.

There are also molybdenum deposits at P'u-pien-tsun and at Shis-p'ing-ch'uan which contain high-grade ore, running in excess of 3 percent molybdenum. Production in these areas has been insignificant, but reserves of molybdenum, although remaining unknown, appear to be substantial. 73/ Tungsten deposits in Communist China contain some molybdenum, but the percentage is low, and reserves are not believed to be very large.

Little is known concerning the mineral resources of the western parts of Communist China. There have been reports from time to time of molybdenum discoveries in this area, but details are lacking. The area may prove to be an important source of molybdenum in the future.

The principal molybdenum deposits in Communist China are listed in Table 6.

Table 6

Principal Molybdenum Deposits in Communist China

Deposit	Coordinates	
	North	East
Shih-fen-kou	42°38'	129°33'
Yang-chia-chang-tzu	40°49'	120°30'
Ma-lu-kou	41°12'	124°18'
Shis-p'ing-ch'uan	28°23'	120°18'
P'u-pien-ts'un	25°53'	118°59'
Ssu-chien-k'eng	25°53'	118°59'
Ch'ih-t'ien-yang	26°39'	119°33'
Hsien-tu	25°03'	117°36'

3. Production and Trade.

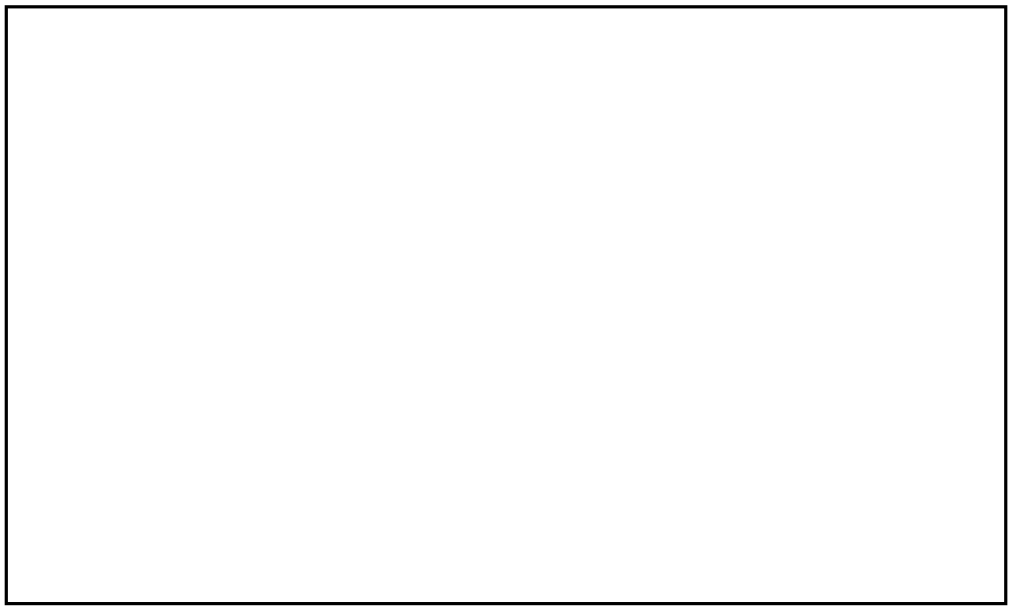
The estimated production of molybdenum in Communist China in 1940-52 is given in Table 7.

Table 7

Estimated Production of Molybdenum in Communist China
1940-52

Metric Tons

Year	Amount
1940	28 a/
1941	55 a/
1942	242 a/
1943	335 a/
1944	335 a/
1945	20 a/
1946-49	N.A.
1950	125 b/
1951	225 b/
1952	325 c/



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Production for the years 1950-52 has been estimated on the basis of available information on production under the Japanese and efforts on the part of the Chinese Communists and Russians to increase production during this period. The Yang-chia-chang-tzu mine, which furnishes all but a small fraction of molybdenum production, came under the control of the Chinese Communists in October 1947. At that time the mine was idle, and the equipment removed or destroyed by the Russians in 1945 had not been replaced. The Chinese Communists lacked the necessary equipment and technicians to rehabilitate the mine and restore a high level of production. The USSR began supplying these needs in 1949 and 1950. The level of production that has been attained since that time has depended primarily upon how freely the USSR has supplied necessary equipment and technicians. Actual production during these years may have been higher or lower than the figures given in Table 7, but it is believed that the margin of error is not large.

Virtually the entire output of molybdenum in Communist China is exported to the USSR in the form of molybdenum concentrates. 75/

4. Supply Position.

A summary of the estimated molybdenum supply position of Communist China for 1950-52 is given in Table 8.

Table 8

Estimated Molybdenum Supply Position of Communist China
1950-52

Metric Tons

Year	Production	Consumption	Imports	Apparent Exports
1950	125	0	0	125
1951	225	0	0	225
1952	325	0	0	325

5. Future Development.

The molybdenum deposits in Communist China provide a raw material base sufficient for a molybdenum industry considerably larger than that which now exists. The development of these deposits depends mainly upon the availability of capital equipment and technically trained personnel, because the USSR already provides a ready market outlet. Considering its need for molybdenum, the USSR probably will provide enough capital equipment and technically trained personnel to assure a high level of production.

B. North Korea.

North Korea is the second ranking molybdenum producer among the Satellites. There is, however, little detailed information available concerning the development and present status of the North Korean molybdenum industry.

1. Principal Deposits.

There are several molybdenum deposits in North Korea, as listed in Table 9, but the Suan deposit is the only one of any importance.

Table 9

Principal Molybdenum Deposits in North Korea

Deposits	Coordinates	
	North	East
Suan	38°42'	120°22'
Choum-ni	38°08'	126°23'
Mokki	38°35'	127°58'
Kumgang	38°38'	127°10'

Little is known concerning the geological characteristics of the North Korean deposits. The Kumgang mine reportedly contains

4 percent molybdenite; the ratio is 3 to 4 percent molybdenite in most of the other mines, with poor deposits ranging as low as 0.3 percent molybdenite. 76/ The extent of North Korean molybdenum reserves is unknown.

2. Production and Trade.

The Suan mine is the principal source of North Korean molybdenum. Current production levels in North Korea are impossible to estimate because of the present war conditions. The estimated production in recent years is given in Table 10. Almost the entire amount of molybdenum produced in North Korea is exported to the USSR, and there is no significant consumption in North Korea.

Table 10

Estimated Production of Molybdenum in North Korea 77/
1947-52

Metric Tons

Year	Amount
1947	8
1948	12
1949	47
1950	58 a/
1950	91
1951-52	N.A.

a. January to August.

3. Supply Position.

A summary of the estimated molybdenum supply position of North Korea for 1947-52 is given in Table 11.*

* Table 11 follows on p. 27.

Table 11

Estimated Molybdenum Supply Position of North Korea
1947-52

Metric Tons

Year	Production	Consumption	Imports	Apparent Exports
1947	8	0	0	8
1948	12	0	0	12
1949	47	0	0	47
1950	91	0	0	91
1951-52	N.A.	N.A.	N.A.	N.A.

C. Rumania.

1. History of the Industry.

Before World War II, molybdenum production in Rumania was insignificant. War demands stimulated production and raised Rumania's output to about 8 metric tons in 1941. 78/ During the latter part of 1941 and in 1942, the Germans partially depleted the leading deposit. Consequently, production dropped sharply in 1943. 79/

In 1948, a Soviet-Rumanian joint company was formed to exploit the remaining Rumanian molybdenum reserves. It was agreed that equipment and special technicians would be furnished by the USSR and that Rumania would provide the mineral deposits and labor. 80/

2. Principal Deposits.

The only important molybdenum deposit in Rumania is located at Baita, in the Bihor Mountains, 9 kilometers east of Vascau. 81/ This mine produces a complex molybdenum-bismuth ore with a molybdenite content varying between 0.15 and 0.45 percent. 82/ The mine is old and had been idle for many years before 1939, when it was reopened. 83/ The Germans operated the mine from 1941 until 1944 and seriously depleted the reserves. In 1946 and 1947 the Rumanians undertook to redevelop and expand the mine, and under Soviet guidance and direction they are striving to recover the maximum possible amounts of molybdenum.

Other small and scattered molybdenum deposits in Rumania are of no economic significance at the present time. Total reserves are unknown, but the Germans estimated the Baita reserves at no more than 125 metric tons of molybdenum content in 1942. 84/

There is, in conjunction with the Baita mine, a small flotation mill, which in 1949 was capable of processing 50 metric tons of ore daily. 85/ The Baita mill produces molybdenum concentrates. There are no other known molybdenum-processing plants in Rumania.

3. Production.

The estimated production of molybdenum in Rumania in 1941-52 is given in Table 12.

Table 12

Estimated Production of Molybdenum in Rumania
1941-52

Metric Tons

Year	Amount
1941	8.0 a/
1942	7.4 a/
1943	4.3 a/
1944-47	N.A.
1948	3.5 b/
1949	3.5 b/
1950	4.0 c/
1951	4.0 c/
1952	4.0 c/

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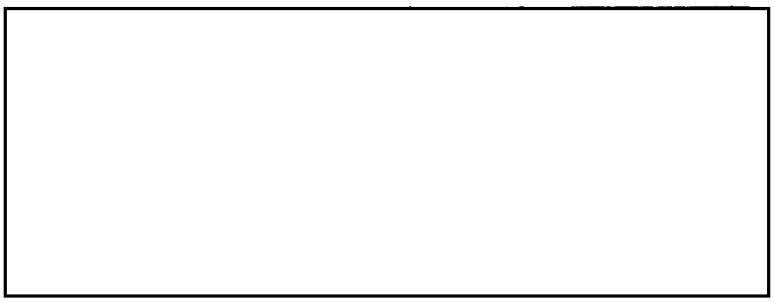

4. Consumption and Uses.

Rumania produces only small quantities of molybdenum-consuming alloy steels. Accordingly, it has been estimated that the ratio of molybdenum consumption to raw steel production in Rumania is no more than 30 percent of that of the US. The figures in Table 13, showing the estimated consumption of molybdenum in Rumania in 1947-52, were calculated on this basis.

Table 13

Estimated Consumption of Molybdenum in Rumania
1947-52

Metric Tons

Year	Iron and Steel Industry	Other	Total
1947	5	Negligible	5
1948	8	Negligible	8
1949	9	Negligible	9
1950	11	1	12
1951	12	1	13
1952	12	1	13

Because of the relatively low state of development of other molybdenum-consuming industries in Rumania, it is estimated that the iron and steel industry accounts for at least 95 percent of consumption.

5. Supply Position.

A summary of the molybdenum supply position of Rumania for 1947-52 is given in Table 14.*

6. Future Development.

The Rumanian molybdenum deposits are not of sufficient size to permit the development of the industry appreciably beyond its present state. All workable deposits, however, probably will

* Table 14 follows on p. 30.

Table 14

Estimated Molybdenum Supply Position of Rumania
1947-52

Metric Tons

Year	Production	Consumption	Exports	Apparent Imports
1947	N.A.	5	N.A.	N.A.
1948	3.5	8	0	4.5
1949	3.5	9	0	5.5
1950	4.0	12	0	8.0
1951	4.0	13	0	9.0
1952	4.0	13	0	9.0

be exploited to the fullest practical extent because of the scarcity of molybdenum in the Soviet Bloc.

D. Czechoslovakia.

1. General.

Czechoslovakia has no molybdenum deposits and hence relies wholly on imports to satisfy domestic requirements. Because of relatively expensive electric power and limited electric furnace capacity, Czechoslovakia has never produced ferroalloys to any extent except for ferromanganese, which can be produced in blast furnaces. 89/ Czechoslovakia imports molybdenum in the form of molybdic oxides, ferromolybdenum, molybdenum metal, and molybdenum products such as molybdenum wire and sheets.

In the past, Czechoslovakia procured its molybdenum supplies almost exclusively from English and other Western European metal brokers, seldom, if ever, purchasing directly from the primary producers, located largely in the Western Hemisphere. 90/ The advent of the embargo on shipments of strategic materials to the Soviet Bloc forced Czechoslovakia to resort to clandestine trade channels to procure molybdenum from the West. Czechoslovak trade representatives in the West have displayed a willingness to pay inordinately high prices for molybdenum in almost any quantity.

These efforts have met with some success, and sizable amounts of molybdenum have moved from the West to Czechoslovakia in the form of transshipments through such countries as Switzerland, Italy, Belgium, Austria, West Germany, and Sweden.

The trade channels that the Czechoslovak iron and steel industry established with the West prior to the Communist domination of Czechoslovakia have unquestionably served as an aid to the Soviet Bloc in its attempts to procure molybdenum from the West by clandestine means. It is probable that these channels are currently being utilized to obtain molybdenum for other members of the Bloc as well as for Czechoslovakia.

2. Consumption and Uses.

Czechoslovakia is one of the leading producers of alloy steel among the Satellite countries and as such consumes approximately 50 percent as much molybdenum in relation to its total raw steel production as does the US.

The estimated consumption of molybdenum in Czechoslovakia in 1947-52, based on this 50-percent consumption factor, is given in Table 15. Ninety percent of the molybdenum is consumed by the iron and steel industries. Czechoslovakia's other molybdenum consuming industries, being relatively highly developed, are estimated to account for 10 percent of total molybdenum consumption.

Table 15

Estimated Consumption of Molybdenum in Czechoslovakia
1947-52

Metric Tons

Year	Iron and Steel Industry	Other	Total
1947	114	13	127
1948	143	16	159
1949	166	18	184
1950	193	21	214
1951	200	22	222
1952	207	23	230

3. Supply Position.

A summary of the molybdenum supply position of Czechoslovakia for 1947-52 is given in Table 16.

Table 16

Estimated Molybdenum Supply Position of Czechoslovakia
1947-52

Metric Tons

Year	Production	Consumption	Exports	Apparent Imports
1947	0	127	0	127
1948	0	159	0	159
1949	0	184	0	184
1950	0	214	0	214
1951	0	222	0	222
1952	0	230	0	230

E. Poland.

1. General.

Poland, having no molybdenum deposits, is wholly dependent upon imports to meet its requirements. Unlike Czechoslovakia, however, Poland has facilities for the manufacture of ferromolybdenum and therefore imports molybdenum in all stages of manufacture from ore concentrates to finished molybdenum products. Before the COCOM embargo on shipments of molybdenum to the Soviet Bloc, Poland imported the bulk of its molybdenum from Sweden, Norway, and other Western European countries. The embargo forced Poland to rely, partially at least, upon clandestine trade channels for molybdenum supplies, as only limited amounts can be imported from the USSR and other areas of the Bloc. 91/ It is not possible to measure accurately the quantities of molybdenum which Poland is able to procure from these different sources at the present time.

2. Consumption and Uses.

Like Czechoslovakia, Poland is a leading producer of alloy steel among the Satellites and is estimated to consume approximately 50 percent as much molybdenum in relation to its raw steel production as does the US. The consumption of molybdenum in Poland in 1947-52 as based on this estimate is given in Table 17.

Table 17

Estimated Consumption of Molybdenum in Poland
1947-52

		Metric Tons	
Year	Iron and Steel Industry	Other	Total
1947	79	4	83
1948	106	6	112
1949	141	7	148
1950	161	8	169
1951	164	9	173
1952	171	9	180

The iron and steel industry consumes an estimated 95 percent of the molybdenum imported. Poland's other molybdenum-consuming industries are not so highly developed as those of Czechoslovakia and consume only an estimated 5 percent of available molybdenum supplies.

3. Supply Position.

The estimated molybdenum supply position of Poland for 1947-52 is given in Table 18.*

* Table 18 follows on p. 34.

Table 18

Estimated Molybdenum Supply Position of Poland
1947-52

Metric Tons

Year	Production	Consumption	Exports	Apparent Imports
1947	0	83	0	83
1948	0	112	0	112
1949	0	148	0	148
1950	0	169	0	169
1951	0	173	0	173
1952	0	180	0	180

F. Hungary.

1. General.

Hungary, like Czechoslovakia and Poland, has no molybdenum deposits and imports its total supply in the form of ferromolybdenum, pure molybdenum metal, and finished molybdenum products.

Under the present Five Year Plan (1951-55), Hungary is placing considerable stress on the development of quality steels and, accordingly, is expanding ferroalloy production facilities. 92/ Ferromolybdenum, however, is not to be produced under the program, and Hungary will continue to rely on imports.

At least part of Hungary's molybdenum requirements are met by imports from the USSR. 93/ Vigorous Hungarian efforts to procure molybdenum from Western sources via clandestine trade channels indicate that molybdenum imports from the USSR fall short of satisfying the demand of the Hungarian iron and steel industry. 94/

2. Consumption and Uses.

Hungary produces relatively large amounts of alloy steel, and its ratio of molybdenum consumption to total raw steel production is estimated to be approximately equal to that of Poland and Czechoslovakia: that is, about 50 percent of that of the US. The iron and steel industry consumes an estimated 90 percent of the molybdenum

imported. Molybdenum consumption by other industries in Hungary accounts for about 10 percent of total consumption.

The consumption of molybdenum in Hungary in 1947-52 is given in Table 19.

Table 19

Estimated Consumption of Molybdenum in Hungary
1947-52

Metric Tons

Year	Iron and Steel Industry	Other	Total
1947	30	3	33
1948	43	5	48
1949	50	6	56
1950	57	6	63
1951	57	6	63
1952	59	7	66

3. Supply Position.

A summary of the molybdenum supply position of Hungary for 1947-52 is given in Table 20.

Table 20

Estimated Molybdenum Supply Position of Hungary
1947-52

Metric Tons

Year	Production	Consumption	Exports	Apparent Imports
1947	0	33	0	33
1948	0	48	0	48
1949	0	56	0	56
1950	0	63	0	63
1951	0	63	0	63
1952	0	66	0	66

G. East Germany.

1. General.

East Germany also is devoid of commercially exploitable molybdenum deposits and is dependent on imports. Although East Germany has ample electric furnace capacity for the manufacture of ferromolybdenum, it lacks the necessary molybdenum ores and concentrates. Therefore, it imports ferromolybdenum, pure molybdenum metal, and fabricated molybdenum products. As have other members of the European Satellite group, East Germany has experienced difficulty in obtaining the required quantities of molybdenum from the West and, as recently as December 1951, was experiencing an acute shortage of molybdenum. 95/

The amount of molybdenum that East Germany is able to import from the USSR is unknown, but, judging by intelligence reports, it appears to be insufficient to satisfy requirements. Evidence of this is found in the current unusually high prices commanded for molybdenum and molybdenum products shipped from Western Europe to East Germany. These prices have ranged up to several hundred percent of US prices for comparable products. 96/

2. Consumption and Uses.

East Germany produces relatively little alloy steel. The ratio of molybdenum consumption to raw steel production in East Germany is estimated to be not more than 30 percent of that of the US. The iron and steel industry consumes an estimated 90 percent of the molybdenum imported. Other molybdenum-consuming industries account for approximately 10 percent of total consumption.

The consumption of molybdenum in East Germany in 1947-52 is given in Table 21.*

3. Supply Position.

A summary of the molybdenum supply position of East Germany for 1947-52 is given in Table 22.**

* Table 21 follows on p. 37.
** Table 22 follows on p. 37.

Table 21

Estimated Consumption of Molybdenum in East Germany
1947-52

Metric Tons

Year	Iron and Steel Industry	Other	Total
1947	3	Negligible	3
1948	14	2	16
1949	23	3	26
1950	41	5	46
1951	62	7	69
1952	87	10	97

Table 22

Estimated Molybdenum Supply Position of East Germany
1947-52

Metric Tons

Year	Production	Consumption	Exports	Apparent Imports
1947	0	3	0	3
1948	0	16	0	16
1949	0	26	0	26
1950	0	46	0	46
1951	0	69	0	69
1952	0	97	0	97

IV. Conclusions.

The molybdenum supply position of the Soviet Bloc has improved considerably in the postwar years. The estimated supply position for 1952 is summarized in Table 23.* The improvement is especially

* Table 23 follows on p. 38.

Table 23

Summary of the Estimated Molybdenum Supply Position of the Soviet Bloc 1952

Metric Tons

Country	Production	Consumption	Exports	Imports
USSR	3,550	3,293 a/	582	325 b/
Communist China	325	0	325 c/	0
North Korea	N.A.	N.A.	N.A.	N.A.
Rumania	4	13	0	9 d/
Czechoslovakia	0	230	0	230 d/
Poland	0	180	0	180 d/
Hungary	0	66	0	66 d/
East Germany	0	97	0	97 d/
Total	3,879	3,879	907	907

a. Apparent consumption.
b. From Communist China.
c. Apparent exports to the USSR.
d. Apparent imports from the USSR.

noticeable in the USSR, where indigenous production and imports from Communist China appear to provide sufficient molybdenum for essential industrial requirements and to leave a small surplus for stockpiling and for exports to the European Satellites. The European Satellites, however, are not so well supplied, and imports from the USSR are not sufficient to meet all eseential needs. Reserves in Communist China are, on the other hand, substantial, and the Bloc appears to be in a position to obtain increased supplies through further exploitation of resources in both the USSR and Communist China.

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